

**REQUIREMENTS FOR PORTABLE INSTRUMENT SUITES DURING HUMAN SCIENTIFIC EXPLORATION MISSIONS.** A. Sehlke<sup>1</sup>, Z. Mirmalek<sup>2</sup>, D. Burt<sup>3</sup>, C. Haberle<sup>4</sup>, D. Santiago-Materese<sup>1</sup>, S.E. Kobs Nawotniak<sup>5</sup>, S.S. Hughes<sup>5</sup>, W.B. Garry<sup>6</sup>, N. Bramall<sup>7</sup>, A.J. Brown<sup>8</sup>, J.L. Heldmann<sup>1</sup>, and D.S.S. Lim<sup>9</sup>. <sup>1</sup>NASA Ames Research Center/USRA, Moffett Field CA (alexander.sehlke@nasa.gov), <sup>2</sup>Harvard Kennedy School, Harvard University, Cambridge MA, <sup>3</sup>Stony Brook University, Stony Brook NY, <sup>4</sup>Mars Space Flight Facility, Arizona State University, Tempe AZ, <sup>5</sup>Dept. of Geosciences, Idaho State University, Pocatello ID, <sup>6</sup>NASA Goddard Space Flight Center, Greenbelt MD, <sup>7</sup>Leiden Measurement Technology LLC, Sunnyvale CA, <sup>8</sup>NASA Headquarters, Washington DC, <sup>9</sup>NASA Ames Research Center/ BAER Institute, Moffett Field CA

**Introduction:** Human explorers on the surface of the Moon, Mars, and asteroids will have access to a far wider array of scientific tools than previous crewed planetary exploration missions, but not every tool will be compatible with the restrictions of this exploration. Handheld spectrometers capable of in-situ analyses are already used for geological exploration on Earth; however, their usefulness for human exploration missions to other bodies in our solar system needs to be evaluated. In order to understand the usefulness of handheld instruments within the architecture of Extra-Vehicular Activities (EVAs), we incorporated three handheld spectrometers, namely a FLIR camera, a visible-near infrared (vis-NIR) and an X-Ray-Fluorescence (XRF) spectrometer, during simulated Mars exploration missions conducted on basaltic terrains in Idaho and Hawai'i as part of BASALT (Biologic Analog Science Associated with Lava Terrains, PI Darlene Lim), a NASA funded research program. We evaluated the performance and data quality provided by these handheld spectrometers in the laboratory under selected metrics, such as measurement time, sample-instrument distance, sample-instrument angle, ambient atmosphere, and sample matrix; and instrument data quality was compared to high-quality laboratory set-ups. Our findings provide guidelines and requirements on how to effectively incorporate these instruments in human exploration missions to other planetary bodies, and conclude that future iterations of these instruments will be beneficial for reliably collecting data to enhance crewed planetary missions.